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ON ACROCYANOSIS CHRONICA ANÆSTHETICA WITH GANGRENE; ITS RELATIONS TO OTHER DISEASES, ESPECIALLY TO ERYTHROMELALGIA AND RAYNAUD'S DISEASE.*

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Vasomotor disturbances are commanding a steadily growing interest. With the demand for knowledge in regard to neuroses in general has come a special effort on the part of scientific men to make clearer the very indefinite vasomotor and trophic group. Pathological evidence is gradually accumulating, and experimental medicine is slowly coming to its aid.

The group includes erythromelalgia, Raynaud's disease, and a great number of symptom-complexes resembling these two somewhat, but not sufficiently to be classified with either. Scleroderma may be included, but it affects the whole body. In this paper we wish to discuss those types which affect the extremities particularly. Cyanosis of the extremities is seen in many heart and lung conditions, and in Osler's polycythemia. The former are easily explicable; the latter, as Senator¹ points out, may be an affection of the bone marrow.

The idea that the vasomotor tropho-neuroses all belong to one group is being more generally accepted, and this is helping much to clear up the indefiniteness of the group. The most confusing factor has been the number of cases which do not fit any of the known clinical types. Indeed, it is

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now commonly suggested that these neuroses may pass from one type through intermediate stages into a second type. Kollarits² mentions cases of erythromelalgia passing into Raynaud's disease. Simple acrocyanosis (cyanosis of the extremities) is often the first stage of erythromelalgia. Legroux³ reports a case of chilblains, passing into permanent local asphyxia, and later developing symmetrical gangrene. Sachs⁴ states "It is very certain that erythromelalgia, Raynaud's disease, acroparesthesia, and even scleroderma often merge into each other, or are associated with one another."

On analysis the symptoms of these vasomotor trophoneuroses fall into three main groups—vasomotor, sensory, and trophic.

The vasomotor symptoms include (1) hyperemia, (2) syncope, and (3) asphyxia; the sensory, (1) pain, (2) hyperesthesia, (3) anesthesia, and (4) paresthesia; the trophic, (1) ulceration, (2) gangrene, and (3) dystrophies of the skin.

Perhaps the simplest type of vasomotor neurosis is simple acrocyanosis, a symptom of the vasomotor group, which is a prominent feature in many more complex neuroses. Mosse¹² reported two cases of the simple acrocyanosis in mother and daughter. Erythromelalgia is characterized chiefly by two symptoms, hyperemia from the vasomotor group, and pain from the sensory. Still more complex is Raynaud's disease with symptoms from all three of the groups. The vasomotor are hyperemia, syncope and asphyxia; the sensory, pain, anesthesia and paresthesia; the trophic, gangrene. In addition the distribution, and the course of the disease, are of value in the diagnosis. All these diseases affect chiefly the extremities, though Weir Mitchell⁵ described erythromelalgia as more common in the feet. Raynaud⁶ stated that his type of spontaneous gangrene occurs alike in hands or feet. The course may be acute, paroxysmal, or chronic.

When the great number of combinations of these symptoms possible is realized, it is not surprising that new clinical types are constantly being described. Among the intermediate forms are Schultze's⁷ acroparesthesia, Nothnagel's⁸ vasomotor neuroses, Cassirer's⁹ acrocyanoses. Cassirer's comprehensive monograph⁹ gives a complete description of each

type of disturbance, and to him credit is due for development of the idea of unification.

Our interest in the subject has been stimulated by the following case, which came to the Surgical Clinic of the Johns Hopkins Hospital for treatment for his toes, and was referred to the medical side as a probable vasomotor neurosis.

B. J., aet. 44, (General No. 57,972), white, married, walked into the ward with a slight limp, making use of a cane.

Complaint: "Nervousness and loss of ends of toes."

Family History: Father, 78, alive and well. Mother, 65, alive and well. Brothers, four, alive and well.

Negative for rheumatism, tuberculosis, neoplasm, or nervous affections.

Past History: Measles, mumps, chicken-pox and whooping-cough when a child. Pneumonia when 25 years old, confined to bed three weeks, with good recovery. No diphtheria, scarlet fever, malaria, typhoid or rheumatic fever.

Head: Not subject to headache. Eyesight is poor and he uses glasses to read. Cannot read very well, because of eye pain and vision is blurred. No trouble with hearing. No nose or throat trouble. No giddy or fainting spells.

Cardio-Respiratory: No cough. Has shortness of breath sometimes after exertion, as on going up stairs. No pain in chest or palpitation of the heart. No expectoration. No hemoptysis. Had occasional night sweats about two years ago, which were not severe; none during past six months.

Gastro-intestinal: Negative. Appetite always poor. Digestion apparently normal. Bowels usually move once a day.

Genito-urinary: No kidney or bladder trouble. No trouble with urination. Had gonorrhea when 18 years old, which was treated and evidently cured. Denies syphilis. No history of secondary manifestations.

Neuro-muscular: Negative.

Habits: Smokes and chews tobacco, about five cents' worth of each per week. From the age of 18 he has been a heavy alcoholic drinker, up to one month before admission.

Work: Postmaster and station agent, necessitating much standing and tramping about in the wet and cold in the winter months.

Present Illness: Duration about 10 years.

The onset was gradual with the development of "cramp-like pains in the legs, which were very severe, and came and went quick as a flash." There was no sensitiveness of the skin in the affected areas, but in the attacks the muscles of the legs became "hard as rocks," sometimes in one leg and sometimes in both. The attacks were paroxysmal, coming on

at night usually, after a hard day's work, and especially after much tramping about in cold, damp weather. They might occur every night for several days, and then he would be free of them for two or three weeks.

Five years ago they disappeared. At this time he worried a great deal about his condition and became very nervous. He would "tremble all over" and did not feel able to do his work. He had great difficulty in reading and writing telegrams.

He remembers several attacks of slight numbness in his fingers, lasting from five minutes to an hour, but does not think they changed color. Nor was there pain associated with the numbness. What bothered him most was the change in the feelings of his legs. The sensations were "not natural." They gradually became numb and felt as if pins and needles were sticking in them. He had them massaged for a time, until he found the skin was being rubbed off without his realizing it.

Three weeks before admission, while taking a bath, he noticed the skin over the second toe of the right foot was wrinkled. On taking hold of it, the nail and part of the end of the toe came off, absolutely without pain. Several days later he pulled off the tip of the big toe upon the same foot in removing his shoes and stockings. There are sores also upon the third toe of the right foot and big toe of the left. At no time has he experienced any pain. During these three weeks the feet and legs have been swollen, especially the right, and their color has been a diffuse deep red, at times changing to a bluish red. There has been no loss of muscle power, but a slight stiffness of the ankles and knees has bothered him in walking.

Examination on admission: Patient was admitted this noon, walking with a slight limp. He was put to bed and the feet dressed at once. After removing a dressing of cotton and carbolic salve, they were cleaned and put up in balsam Peru. The first two toes of the right foot showed an ulcerating surface with considerable loss of tissue, exposing the bone of the terminal phalanges. The tissue surface was clean and moist. There was no pain or tenderness even on the raw surfaces. An abrasion of the skin of the third toe was covered with a hemorrhagic crust. On the plantar surface of the ball of the left big toe was a cleanly-cut, round ulcer, rather superficial. Both legs were edematous to the knees, the right the more so, and the right was more red and hot. Both feet were cyanotic, shading to a pink color on the legs. A faint pulsation was felt in the dorsalis pedis artery of the right foot—a better one, though still weak, in the post-tibial. A good pulse was felt on the left. Pulsation was strong in both femoral and popliteal arteries. No special enlargement or tenderness of the glands.

of the groin. No red lines of lymphangitis. Patient complains of anesthesia to touch over the lower legs. Rough examination shows it present to some degree below the knees. No pain complained of, even when the fibers of cotton were being picked from the raw surfaces.

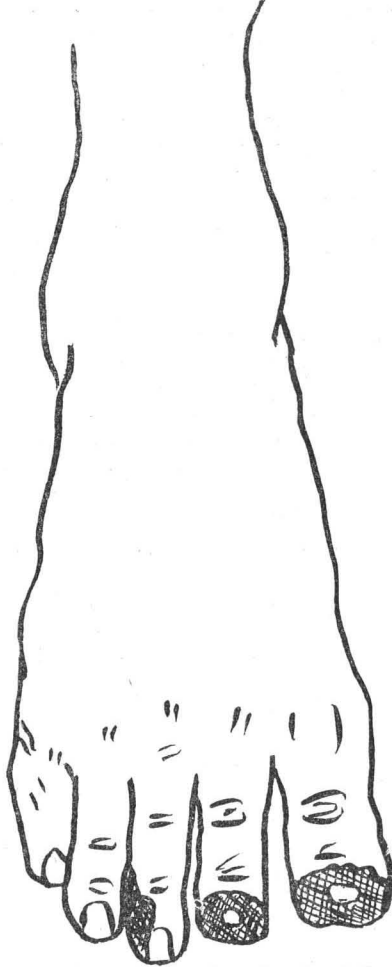


Fig. 1. Sketch of right foot, showing slough of the first two toes and abrasion on the third.

Face flushed. Dilated venules over nose and cheeks. Eyes: suffused; pupils react to light and accommodation; muscular movements good; scleræ clear; conjunctivæ rather pale. Ears: negative for topi or discharge; no pain on pressure over audit-

ory canal or mastoid. Lips clean. Mucous membranes fair color. Tongue slightly coated with small clean ulcers on edges. Tonsils a little large. No reddening or plugs. Moderate injection of pillars and pharynx. Neck negative. Thyroid gland not palpable. No general glandular enlargement.

Chest: Well formed. Epigastric angle about 90 deg. Expansion fair, equal. Vocal fremitus everywhere present. Lungs clear on percussion and auscultation, except for occasional squeaking rales scattered here and there.

Heart: Point of maximum impulse not visible or palpable. Sounds heard best in fourth interspace about 8 cm. from median sternal line. Relative cardiac dullness to mamillary line to left in fourth interspace, and 3 cm. to right in third interspace and up to upper border of third rib. Sounds clear at apex and base. Aortic second and pulmonic second both loud, pulmonic second slightly the louder.

Pulse: 25 to $\frac{1}{4}$, regular in force and rhythm; good size; moderate tension; vessel wall just felt.

Abdomen: Looks natural. Respiratory movements free. No tenderness, muscle spasm, or rigidity. Tympany in flanks. Spleen not felt and dullness not increased. Liver dullness from fourth interspace to two fingers' breadth below costal margin in right mamillary line. Edge indistinctly felt.

Genitalia: Negative; no scars, no discharge. Testicles normal.

Reflexes: Knee-jerks active and equal; Achilles reflexes present. Plantar reflexes normal. Biceps, triceps, and perior-teal radial reflexes active and equal. Abdominal and cremasteric reflexes present.

Note:—The accompanying chart shows the partial sensory disturbance.

Note, 4th day of admission: Arteries at wrist not palpable. Temporals not increased. Femoral pulse palpable.

Left arteria dorsalis pedis is palpable,—not felt on right. During examination right foot becomes bathed in sweat, left only slightly so. Posterior tibial artery is palpable on both sides. On left foot is a small round ulcer, on ball of big toe, covered with bloody scab. On right foot, tip of big toe is gangrenous, exposing last phalanx; also second toe. On outer side of third toe is a superficial ulceration covered with scab. Right foot the warmer.

Reflexes: Biceps lively on right and left, others not remarkably active. Knee-kicks present. Babinski negative.

If pulse in right arteria dorsalis pedis is not absent, it is greatly diminished.

Note, 14th day of admission: After two weeks in bed, the superficial ulcer on left big toe was healed, as was the abrasion on the third toe of the right foot. But the raw surfaces

of the first and second toes on the right showed no such tendency, until the terminal phalanges were disarticulated by Dr. Sowers. The recovery then was uneventful.

It was at this time, however, that definite hyperesthesia of the soles of both feet developed. Patient could not endure the bed clothes upon them at times. As he explained it, "they were extremely sensitive."

Note, on 28th day after admission: Both upper extremities and lower are moderately cyanosed. The toes look much as they did before operation, except that the exposed ends of the bones are missing. There is a palpable pulsation in each *arteria dorsalis pedis*. There is very slight anesthesia to pain

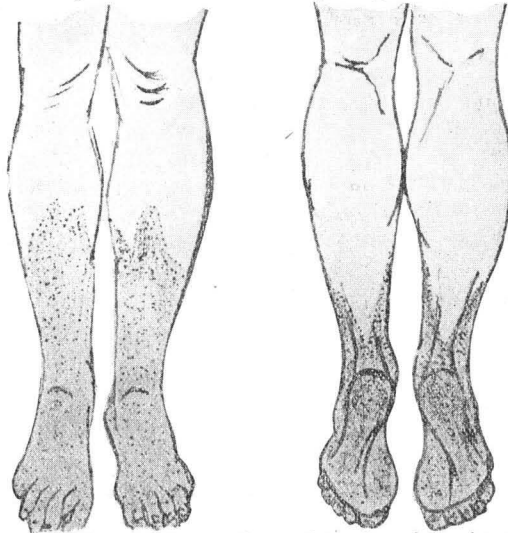


Fig. 2. Areas of impaired sensations of touch, pain and temperature.

in lower limbs. Evidently marked disturbance in temperature sense below knees, especially in lower half of legs. No marked disturbance in kinesthetic sense in both legs (at toes), though a little dulled; sharp at ankles and knees. Hands and feet are now markedly cyanotic; a considerable increase is noted in the cyanosis since the examination began. Bone vibrations (of tuning fork) are well felt in upper extremities and in tibiae; but are a little dull in feet. No dulling at all in upper extremities distally. No hemianopsia. Cyanosis now at wrist. Marked goose-flesh. It is important to note how the cyanosis has progressed during the 15 to 20 minutes of examination.

Note on 42nd day: Marked cyanosis of right foot. Big toe now looks well. Cyanosis of left foot comes out under examination. Hands cold and cyanotic. Radial pulse good,

also that in the arteria dorsalis pedis—the left pulsates more than the right. Posterior tibial artery beats on both sides. Some pain in the second toe, and some pus can be expressed.

There is no syncope when the fingers are immersed in ice water, nor asphyxia when in warm water.

On discharge: Hands cyanotic to-day. Right foot is normal. Left foot shows slight anesthesia. Knee-jerks are present and active. Plantar reflexes normal. Pulse is better in the left dorsalis pedis artery than in the right. No muscular atrophy.

The blood examination on admission showed: Red blood corpuscles, 4,354,000; hemoglobin, 86 per cent. by the Sahli instrument. It remained practically the same and on discharge there were: 4,644,000 red blood corpuscles, and 85 per cent. hemoglobin (Sahli).

A leucocytosis of 19,460 on admission was associated with a slight bronchitis; it fell gradually to 6,740 on rest in bed and after the amputation and cleansing of the wounds.

The differential count on smears made when the leucocytes were 19,460 was:

Polymorphonuclear neutrophiles	...468 or 93.6%
Polymorphonuclear eosinophiles	... 6 or 1.2%
Large mononuclears	 7 or 1.4%
Transitionals	
Lymphocytes	 18 or 3.6%
Mast cells	 1 or 0.2%
Myelocytes	 0 or 0.0%

Total	500 cells 100%
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No nucleated red blood corpuscles are found.

The fresh blood at no time showed any evidence of the presence of parasites.

The coagulation time was delayed,—10¼ and 12½ m.,—on two observations by the Boggs instrument.

The blood pressure (maximal) varied from 100 to 120 mm. of mercury by the Riva Rocci instrument.

The temperature rose during a throat infection, and the increase in the rate of the pulse and respirations was parallel. Otherwise pulse and respiration were normal.

Urine: 800 to 1,400 c.c. daily; yellow to orange in color; specific gravity 1.020 on the average; no sugar; an occasional faint trace of albumin and an occasional granular cast; no bile pigments.

Sputum and Stools: negative.

Weight, 131 pounds on admission; 127 pounds in second week; and 133 pounds on discharge.

An analysis of this case with the schema above described kept in mind, will make its nosological localization simple.

The vasomotor symptoms present are (1) cyanosis, and (2) swelling of the soft parts; the sensory are (1) paresthesia, (2) anesthesia, not in the distribution of any nerve, (3) hyperesthesia, and (4) no pain; and finally, the trophic are (1) dystrophy of skin over toes, (2) subsequent loss of tissue, exposing the bones, and (3) a *malum perforans*.

Localization: the fingers, the toes, feet and legs, but more on the right than on the left.

Course: Chronic, progressive, and not paroxysmal.

This agrees, as it will be seen, with no one of the symptom-complexes above described. In considering the differential diagnosis a number of diseases might be thought of. The case can scarcely be regarded as Raynaud's disease. The absence of syncope and of pain, and the fact that it is not paroxysmal distinguish it. There are no attacks of red, white and blue fingers. There was, however, gangrene.

Erythromelalgia is characterized by a hyperemia rather than a cyanosis; by pain and hyperesthesia, not anesthesia and paresthesia; by the absence of gangrene and such trophic disturbances. The dependent position brings on the attack.

Diabetic gangrene with neuritis and arteriosclerosis is excluded by the urinary examinations.

Senile gangrene is not warranted by the age of the patient or the condition of the arterial walls.

Tabes dorsalis, despite the anesthesia and *malum perforans*, can be ruled out. The knee-jerks are active on both sides. The pupils are equal and react to light. The muscle sense is nearly perfect.

Syringomyelia need not be considered, since the lower extremities are chiefly affected, the anesthesia does not present the type of syringomyelic dissociation, and there is no segmental distribution of the anesthesia, and no muscular atrophy.

Peripheral neuritis cannot be excluded. Certainly the peripheral nerves are involved and the alcoholic history and the plantar hyperesthesia are very suggestive. The muscle power is not affected. There is no muscular atrophy or fibrillary twitching. There is no pain. The leprous form (*lepra mu-*

tilans) is excluded by there being no thickening of the peripheral nerves, especially *N. auricularis magnus*, nor islands of anesthesia, nor a leontine facies. How large a part the involvement of the nerves plays in the development of the syndrome we cannot be certain.

Finally the symptomatic diagnosis of acrocyanosis or acroasphyxia may be made with certainty. This really is but a symptom, which indeed our case shows prominently. But Cassirer⁷ makes this symptom the keystone to many complexes, qualifying it symptomatically by *chronica*, *anæsthetica*, *hypertrophica*, and so on as the case may be. He describes a case which he thinks is unique, in a maiden of 19. The trouble followed frost bites. The hands and feet became bluish red and cyanotic, but not syncope occurred. Paresthesia was complained of. Small fissures on the hands were painless. All the sensory modalities were impaired somewhat. There was no muscular atrophy and motility was interfered with only by the stiffness of the joints due to the swelling. This complex he calls "*Acrocyanosis chronica anæsthetica*," on the basis of symptomatology.

Nothnagel⁸ describes the only other case like it which can be found in the literature. Briefly, it was in a kitchen maid of 28, who was accustomed to soaking her hands in water. Numbness and tingling in the finger tips appeared first. They felt dead. Later the hands and feet were involved and cyanosis developed. There was no pain or muscular atrophy, but the sensory disturbances were general.

Our case differs from these only in the addition of gangrene and ulceration. The other symptoms are almost identical. So we might agree with Cassirer that our case is one of *Acrocyanosis chronica anæsthetica*,—but with gangrene. Considering the group as a whole, our case is one step from *Acrocyanosis chronica anæsthetica* toward Raynaud's disease.

Cassirer describes many cases which lead to hypertrophy of the soft parts and resemble acromegaly, like Kollarits' case, for instance, but in his complete survey of the literature previous to his time, he found none which led to gangrene.

Legroux³ reports a case of "permanent local asphyxia" of the hands and feet, following chilblains. The trophic disturbances were marked in the skin and finger nails, and there was

a spontaneous amputation of the terminal phalanx of the right forefinger, absolutely without pain. Muscle power was intact. Cassirer does not mention this case among the acrocyanoses, but discusses it under Raynaud's disease. Of course it is clear that it is almost identical with our case.

In another case of Legroux's, following chilblains, acrocyanosis was followed by gangrene and spontaneous amputation of the terminal phalanges of the third and fourth toes of the left foot and later of the small toes of both feet. But the analogy is incomplete on account of the presence of pain in the second amputation. Pain, of course, allies this case still closer to Raynaud's disease.

Legroux suggests that in these cases the chilblains, the permanent symmetrical asphyxia, and the subsequent gangrene are degrees more and more accentuated of a neuropathic dystrophy.

Elsner¹⁰ and Sachs¹¹ have reported cases of erythromelalgia associated with gangrene, but these cannot be confused with our case. The pains and the intensification of the symptoms when the extremity is in the dependent position make the distinction clear.

In fine, we have found but one case in the literature similar to ours—that of Legroux's. These two we feel are intermediate forms more closely allied to the acrocyanoses than to either erythromelalgia or Raynaud's disease. And we suggest as a rational terminology clearly representing the type "Acrocyanosis chronica anæsthetica cum gangræna."

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